# INNOVATION IN THE AUSTRALIAN SPATIAL INFORMATION INDUSTRY

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## ABSTRACT

Business literature reveals the importance of generating innovative products and services, but much of the innovation research has been conducted in large firms and not replicated in small firms. These firms are likely to have different perspectives on innovation, which means that they will probably behave differently to large firms. Our study aims to unpack how firms in Spatial Information perceive and engage in innovation as a part of their business operation. To investigate these questions we conduct 20 in depth interviews of top management team members in Spatial Information firms in Australia.

We find that small firms define innovation very broadly and measure innovation by its effect on productivity or market success. Innovation is seen as crucial to survival and success in a competitive environment. Most firms engage in product and/or service innovations, while some also mentioned marketing, process and organisational innovations. Most innovations were more exploitative rather than exploratory with only a few being radical innovations. Innovation barriers include time and money constraints, corporate culture and Government tendering practices. Our study sheds a light on our understanding of innovation in an under-researched sector; that is spatial information industry.



***KEYWORDS: INNOVATION, SMALL FIRMS, AUSTRALIA, EXPLOITATIVE INNOVATION, SPATIAL INFORMATION***

INNOVATION IN THE SPATIAL INFORMATION INDUSTRY IN AUSTRALIA

## INTRODUCTION

Business literature reveals the importance of generating innovative products and services (e.g. Branzei and Vertinsky, 2006, Xerri and Brunetto, 2011), making innovation a widely discussed topic in business, information technology, engineering, and public development contexts (Unsworth et al., 2012). However much of the innovation research has been conducted in large firms, leaving small and medium size firms (SMEs) largely unstudied. (Hoffman et al., 1998)., Recent research calls for investigation of the innovation-performance among SMEs in particular, because they differ from large firms (Rosenbusch et al., 2011). SMEs are likely to have different perspectives on innovation, with different resource constraints, and may carry out innovative activities differently to large firms. Overall, our research question explores how firms in Spatial Information perceive and engage in innovation as a part of their business operation.

To investigate this research question, we conduct a study of the Spatial Information (SI) Industry in Australia. The SI firms are considered as the backbone of our national infrastructure from surveying and mapping to geographic information systems (GIS) and location based services. An estimate of income is approximately $926 million (Australian Bureau of Statistics, 1999) and a total of around 93,000 people are directly involved in spatial information services in industry and government. Given a limited study of this sector, an implication of innovation literature may not fully reflect the nature of this sector. For example, while innovation is heavily gauged by production innovation and/or research and development investment (as a proxy), SI firms, which are mostly small to medium enterprises, heavily focus on service provision by utilizing an existing technology/product (rather than inventing a new wheel). Thus, it is important to understand how SI firms define innovation and what current innovation engagement is. Our study aims to provide a preliminary framework of innovation practice in this specific sector through this exploratory view.

The remainder of this paper is organised as follows. In the literature review we report variations in the definitions of innovation, what we know about the importance of innovation in SI firms (mainly small firms), and how small firms differ from large firms. Then we describe our methodology and report our findings. We conclude with a discussion of our

contributions to SME and innovation literatures, the limitations of our study and suggestions for future research.

## LITERATURE REVIEW

In this section we report variations in the definitions of innovation, what we know about the importance of innovation in SI firms, and how small firms differ from large firms.

### How do we define innovation?

Innovation has been described as a multidimensional phenomenon that is notoriously ambiguous and lacking either a single definition or measure (Adams et al., 2006). In the following section we provide a short overview of the different views on the definition of innovation from the literature to provide dimensions for investigation in our study.

#### *Innovation is understood as both a process and an outcome*

There is general consensus among innovation scholars that innovation encompasses something novel. A recent literature review describes innovation as either a process or an outcome (Crossan and Apaydin, 2010). Some scholars believe that the newness is in the process (Acs et al., 2002, Avermaete et al., 2003, Garcia and Calantone, 2002, Huggins and Johnston, 2009, Katila and Chen, 2008), whereas others believe innovation to be the outcome of a process (Camisón-Zornoza et al., 2004, Huse et al., 2005). Process scholars believe innovation to be a complex series of various actions (Gopalakrishnan and Damanpour, 1994) that ultimately aim at introducing something new at the organisational level (Avermaete et al., 2003). Therefore their research stream focuses on the question of what facilitates this process , such as learning, applying knowledge, exploration and championing of individuals (Cho and Pucik, 2005, Katila and Chen, 2008, De Jong and Kemp, 2003) or social mechanisms such as networks and organisational culture (Brunetto and Xerri, 2011, Obstfeld, 2005)

Outcome scholars describe innovation as a relatively new manufactured product (Parthasarthy and Hammond, 2002) or merely the attempt to commercialise newly discovered methods or materials (Freeman and Soete, 1997), albeit others believe there is no innovation unless the new results are economically successful (Bucic and Ngo, 2012, Çakar and Ertürk, 2010, Denti and Hemlin, 2012, Hipp and Grupp, 2005). Others see innovation as the result of

a process that can even have negative consequences, such as overturning a firm's existing competencies, skills and know-how (Gatignon et al., 2002). Outcome scholars focus on studying factors that might lead to innovation results, such as public subsidies (Albors-Garrigos and Barrera, 2011) or R&D cooperation (Becker and Dietz, 2004).

*Innovation as new to the industry, new to the firm and new to the world*

Scholars defining innovation as a new outcome of a process emphasise different locations of this newness. Some believe innovations are by definition (relatively) new to the industry or market (Parthasarthy and Hammond, 2002, Salavou et al., 2004), yet many scholars think that the newness of the innovation itself is less relevant than the newness for the innovator (Bos-Brouwers, 2010, Hill and Rothaermel, 2003, Howell et al., 2005, Souitaris, 2001).
Another way scholars deal with innovation newness is by differentiating between radical and incremental innovation. Radical innovations involve the use of new technology or knowledge (Cardinal, 2001, Chandy and Tellis, 2000, Goktan and Miles, 2011, Leifer et al., 2001) and are perceived new to the industry (Johannessen & Olsen 2001). These innovations involve substantial technical risks, time and costs (Roussel et al., 1991). In contrast, incremental innovations are the result of a continuing process of improvement (Goktan and Miles, 2011), based on existing knowledge (Cardinal, 2001) or technology (Gatignon et al., 2002). They are new to a certain firm but not to the industry in general (Johannessen et al., 2001). The difference between radical and incremental innovations may seem strict, yet Baumol (Baumol, 2002) argues that most new products fall somewhere in between these two categories.

Additionally, scholars differentiate between firms that generate (radical or incremental) innovations themselves and those that rather adopt those innovations that were developed elsewhere (Damanpour and Daniel Wischnevsky, 2006). The majority of firms adopt rather than generate innovation (Pérez-Luño et al., 2011) and this is particularly the case for smaller firms (Verhees and Meulenberg, 2004).

**Various definitions but what the innovation is for SI firms?**

Although the need for more innovations is widely recognized, there is no commonly accepted view of what innovation means across industry sectors (Sawang and Unsworth, 2011). The word of innovation is entering conversations everywhere, whether talking technology or the world economy. Whereas some studies do not differentiate at all between the different

innovation types (Chassagnon and Audran, 2011, Denti and Hemlin, 2012, De Jong and Kemp, 2003, O'Cass and Weerawardena, 2009) many scholars see innovation mainly as the development of new products (Cooper, 2011, Laforet, 2008), while other studies differentiate between product, process and service innovations (Acs et al., 2002, Parthasarthy and Hammond, 2002, Thornhill, 2006). According to previous literature, there are no clear-cut definitions, as there is no general agreement on the exact differences between these concepts. Therefore, it is important to understand how firms, especially in under-researched sector such as SI, define innovation and engage with it. Product innovation, for instance, is defined as a new product that a firm produces (Goktan and Miles, 2011). Among SI firms, which are service orientation, one may argues that the definition of innovation as product should be excluded. Yet, product innovation can be defined broader as the development of both new products and/or services (Armbruster et al., 2008, Huse et al., 2005, Rundquist, 2012). Therefore, SI firms may perceive innovation as a new product such as a new service plan for customers.

The same lack of clarity can be found with regard to service innovations. Some scholars believe service innovations are distinctively different from product or process innovations; others think they are very similar, and again others argue a synthesis approach (Coombs and Miles, 2000). More agreement is present on the definition of process innovations, that is mostly defined as altering and improving the technical systems or production processes for product innovation (Camisón-Zornoza et al., 2004, Garcia and Calantone, 2002, Goktan and Miles, 2011, Huse et al., 2005)

Other forms of innovation that are generally distinguished in the literature are managerial innovations, which involve changes in an organisation's structure and administrative processes (Madrid-Guijarro et al., 2009), marketing innovations which involve changes in marketing to potential or existing customers (Halpern, 2010) and market innovations, the exploitation of new markets and the penetration of new market segments

within existing markets (Avermaete et al., 2003). The natures of SI firms are small and limited resources. Therefore, the degree of marketing innovation may be fewer comparing to product/service innovation. Yet, it can be argued vice versa, thus an in-depth exploration of how SI firms perceive and engage in innovation is important. For the purpose of this study, we define innovation very broadly as ideas, systems, technologies, products, processes, services, or policies that are new to the adopting organisation (Sawang and Unsworth, 2011, Zaltman et al., 1973) so we do not exclude any of these factors that SI firms might include in their definition of innovation.

**Why is innovation important to SI firms?**

There is a wealth of research stressing the importance of innovation for both countries and industries as individual firms. Firstly, innovation is believed to be the main driver of economic growth (Bos-Brouwers, 2010). Its resulting new processes and products contribute to productivity improvement for the economy as a whole, thereby increasing the basis for economic growth and rising living standards (OECD, 2004). Therefore, many government policies aim at increasing innovation to boost their economy (Baer and Frese, 2003, Forsman, 2009). Secondly, innovation has been found to benefit SI firms, which are small and medium sizes, in several ways, most importantly as a vital factor for developing and sustaining competitive advantage (Branzei and Vertinsky, 2006, Xerri and Brunetto, 2011, Parida et al., 2012). Being innovative helps SI firms to stand out from competitors, establish temporal monopolies, compete with established larger incumbents, grow and generate new quality jobs (Mazzarol and Reboud, 2008, Rosenbusch et al., 2011). The learning that takes place during the innovation process further generates absorptive capacity (Rosenbusch et al., 2011), the skill to recognise external knowledge, assimilate and apply new knowledge that firms need to survive (Jansen et al., 2005). The literature illustrates a number of benefits for SI firms to be innovative, therefore promoting innovation practices within this sector is important.

**How to promote innovation in SI firms**

SI firms, which are mainly small, may innovate differently from other large companies (Bos-Brouwers, 2010, Dodgson and Rothwell, 1991) and therefore we will now discuss common factors that have been found to influence innovation in SI firms. Research on factors that facilitate or impede innovation in small firms can broadly be divided into three groups: firm characteristics, internal and environmental factors.

*Firm factors*

Results regarding firm characteristics enhancing or inhibiting innovation appear contradictory: studies have found that mid-size (Van de Vrande et al., 2009) or larger (Branzei & Vertinsky 2006) firms are more innovative than others, but also that firm size has no significant effect on innovativeness (Camelo-Ordaz et al., 2012) and that innovation is mainly triggered by the firm's environment rather than from within firms (Barrett and Sexton, 2006).

*Internal factors*

Quite a number of studies have found several firm internal factors that might facilitate or impede small firms' innovation. Firstly, there is the crucial role of people, since small firms are often people oriented rather than system oriented (McAdam et al., 2004). Firms with an owner-CEO are found to be more innovative than others (Souitaris, 2001). Owners have the power to make quick decisions and pursue innovation activities (Barrett and Sexton, 2006). but when the CEO has a dominant role without the necessary vision, he can constrain innovative activity (Barrett and Sexton, 2006). Small firm managers, for instance, can increase firm innovation by supporting innovative behaviour (Brophey and Brown, 2009) and being favourable to risk taking (Souitaris, 2001). However, their perceptions of issues related to costs (Madrid-Guijarro et al., 2009) or failure to provide enough support for innovation (Xerri and Brunetto, 2011) can hamper it. Also, an intrapreneur's organisational tenure, business background, age and educational level all have a negative influence on innovation (Camelo-Ordaz et al., 2012)

Secondly, organisational culture is of importance for a firm's innovativeness. A low power distance and little bureaucratic surroundings (Çakar and Ertürk, 2010)or a climate for initiative and psychological safety (Baer and Frese, 2003) can foster innovation, whereas tensions related to ownership issues, control and management (Van Es and Van Der Wal, 2012) or systems based more on rules and procedures and uncertainty avoidance (Çakar and Ertürk, 2010) negatively affect innovation. This can also be said about a firm's day-to-day

delivery pressures imposing time constraints on staff to work on ideas (Brophey and Brown, 2009) and about a firm's financial constraints (Madrid-Guijarro et al., 2009) or lack of resources (McAdam et al., 2004)

Thirdly, firm policies can matter to SME innovation. Prioritising human resource development increases innovation (Barnett and Storey, 2000), whereas a lower HR resource commitment can be a barrier for innovation (Madrid-Guijarro et al., 2009). Firm proactiveness and scanning (Khan and Manopichetwattana, 1989), technology sourcing (Parida et al., 2012), R&D intensity accompanied by a higher level of functional integration (Parthasarthy and Hammond, 2002) and the inclusion of new technology plans in the business strategy (Souitaris, 2001) have all been found to positively affect innovation.

Finally, networks are an important enabler of firm innovation. Relationships with clients (Ceci and Iubatti, 2012), technical interaction with other professionals (Khan and Manopichetwattana, 1989) and using external advice (Higón, 2012) are important tools to generate innovation. The more heterogeneous and stronger a firm's networks are, the more the SME can obtain the advantages of a larger size firm, whose resources, skills and capabilities lead to a greater innovation breath (Gronum et al., 2012).

*Environmental factors*

Customers are an important trigger to innovation (Barrett and Sexton, 2006). Van Es and Van der Wal (2012) contend that innovative small firms' behaviour is usually based on customer input. Other environmental triggers are presented in the form of new legislations, spurring companies into action (Avermaete et al., 2003, Brophey and Brown, 2009). Moreover, research has shown that the more dynamic (Khan and Manopichetwattana, 1989), challenging (Madrid-Guijarro et al., 2009) or uncertain (Uzkurt et al., 2012) a SME's environment is, the more innovative they are, as they are challenged to respond to this by constantly finding new solutions for their business. External factors that have been found to hinder innovation are an industry's preference for the status quo (Brophey and Brown, 2009)and shareholders who are focussed on short term profits (Van Es and Van Der Wal, 2012).

Based on literature review of firm characteristics, internal and environmental factors, which can influence innovation practices, our study will therefore employ the three elements as framework in qualitative analysis of the data.

## METHOD

In this study, we examine innovation activities in a specific industry that is the Spatial Information (SI) sector- firms that are classified as Surveying and Mapping Services according to the latest Australian and New Zealand Standard Industrial Classification code. The SI sector has been recognised as a discrete sector in Australia since 2001. The industry is mainly small firms with a few large firms for comparison. SI is also a good industry for our study because it has two clear segments; the traditional surveying industry using mature technology (our low tech segment), and SI firms using new technologies, such as Global Positioning Systems technology (our high tech segment).

We conducted semi-structured interviews with the top management team members of a theoretically selected sample of 20 SI firms in Australia. Samples for qualitative studies are generally much smaller than those used in quantitative studies. To determine the sample size in qualitative study, we should follow the concept of saturation (Glaser and Strauss, 1967). Our study found that at 15$^{th}$ firm, the information became saturated and collecting five new firms did not shed any further light on our research questions

Given that SI firms are small and often service focused, it is important to understand how these firms conceptualize innovation and how they integrate the innovation aspect into their operations. The following section describes our sample selection.

### Organisation cases and participants

A guided non-representative sample was created from the a list of organisations in the spatial industry business association (SIBA) members list, including surveying and other spatial firms with different sizes on both the east and west coast of Australia. The Spatial Information is a rapidly growing industry that consists of companies offering a wide range of geographic-related services such as surveying, remote sensing, location based services, photogrammetry, mapping, aerial imagery, land development, environmental management, geographic information systems, web services and Global Positioning Systems (GPS) amongst others. The SI industry contributes approximately $12.5 billion annually to Australia's gross domestic product. This industry includes a diversity of firms; some with a history of surveying and other spatial service firms more focused on the application of

information technology. Some small firms are family businesses while medium sized firms are partners in international collaborations.

We have included four firms in Queensland, four in New South Wales, five in Western Australia, six firms in Victoria and one in the Australian Capital Territory. We began with a list of companies obtained from Spatial Industries Business Association (SIBA), and contacted companies to request their participation in face-to face semi-structured interviews with one member of the research team. We updated existing information from information provided and ascertained through company information on the web and phone conversations who would be the appropriate personnel with direct involvement with innovation. Table 1 is a list of key informants.

Due to the different firm activities within SI industry, it is appropriate to cluster SI firms into three groups: *Category A*: Predominantly Surveying firms; *Category B*: Predominantly Spatial Sciences firms and *Category C* Combination of Surveying and Spatial Sciences firms. Category A firms' primary activities are measuring, assembling and assessing land and geographic related information to be used for land planning and implementing the efficient administration of the land and the structures thereon, e.g. engineering and mining surveyors or boundary surveyors. These firms predominantly use mature technologies. Category B firms consist of spatial information users and information technology firms that manage and analyse data that has geographic, temporal, and/or spatial context. This category also includes development and management of related information technology tools, such as aerial and satellite remote sensing imagery, GPS, and computerised geographic information systems (GIS). These firms predominantly use new and emerging "high tech" technologies.

Insert Table 1 about here

**Procedure**

An interdisciplinary research team was used for data collection, in accordance with the methodology described. A team of three researchers and one graduate student with strengths in innovation, entrepreneurship, strategy, marketing, history, technology management and organisational behaviour worked on this project. This disciplinary breadth enabled a multi-perspective, interactive examination of the phenomenon of interest. The diverse perspectives

of the multidisciplinary research team shaped the development of the interview protocols for the semi-structured interviews, the data collection and data analysis, generating rich discussions and insights. The interview protocols were also discussed with industry experts to ensure appropriate terminology and language were used in the data collection phase.

An interview protocol developed from in-depth discussion of the different dimensions of the research questions was trialled during the first few interviews and the modifications developed were used throughout the project. Semi-structured face to face interviews that on average lasted approximately 1 to 1.5 hours were employed to explore the activities and orientation of 20 firms structured interviews. The interview protocol was much broader than the information presented in this paper, given the comprehensive nature of the overall research program. We developed question areas investigating aspects of business strategy, innovative activities, organisational interfaces, processes, skills, metrics, culture, and leadership. We used semi-structured interviews to have comparability across firms and used these interviews to obtain better ideas about issues of importance to them.

All interviews were recorded and transcribed and interviewers also took field notes. Both transcribed interviews and the field notes were used in the data analysis. In addition to the face to face interview and company observations with each company during the site visits, follow-up phone calls or emails were used to seek clarification or greater depth in particular areas.

## FINDINGS

Our study aimed to answer “how do firms in Spatial Information perceive and engage in innovation as a part of their business operation?” Based on thematic analysis, we identified three main themes, i.e. innovation perceptions, innovation engagement and innovation facilitators/impediment. We also identified five sub-themes for innovation engagement (measurement, roles, activities, exploration-exploitation, and beneficial gains) and three sub-themes for innovation facilitators/impediment (firm characteristics, internal and external factors).

**Innovation perceptions**

In order to gain insights into the firms' understanding of innovation, we enquired of the interviewees how they define innovation. Figure 1 provides an overview of their responses, highlighting that there is no broadly prevailing definition of innovation. The most frequently mentioned factor from more than half of the participants was that innovation was something new, usually to enable an increase in efficiency or problem solving. Examples are:

> *I would say it is solving a problem in a unique way* (B1).
>
> *Innovation on is how you do surveys, and how you deliver surveys* (A1).

Other interviewees referred to the use of new technologies, software or instruments (mentioned by almost one third of participants) and to different ways of thinking and approaching issues that arise in firms (mentioned by two participants). Example are:

> *It's the new thought process. Bringing in fresh ideas, new ideas* (C1).
>
> *(Our) innovation is in the laser scanning environment ... it is 3D modelling, visualization (C2).*

Insert Figure 1 about here

From Figure 1 illustrates that SI firms define innovation in very broad terms. Most described innovation as something new in general, to be more efficient or to solve a problem. One could use the saying "Faster, better, cheaper".

*Proposition 1: SI firms are more likely to perceive innovation as new to the firms rather than new to the industry or to the world.*

*Proposition 2: SI firms are more likely to perceive innovation as ways to increase their work efficiency which then turn into business growth.*

**Innovation engagement: measuring innovation**

Most interviewees suggested measuring changes in productivity or market success, while fewer interviewees suggested measuring changes in firms' R&D expenditure or in their efficiency. (Figure 2). Example are:

*Find out how much of a company's revenue stream came from the same product they were offering last year* (B6).

*I would look at ROI (return on investment)... we spent $100K on a piece of equipment, we want to attribute $200K worth of work on that equipment in that year* (C3).

*It would be speed and accuracy and the cost of acquiring those products* (A4).

*A lot of the improvement is coming about through IT, you know, speed of processes and that sort of thing, you could measure the amount of time it would have taken to do a certain area in you know, in different times, you know in five year increments* (B8).

Several other interviewees referred to a broad range of answers, such as the number of developed software products or client satisfaction. As shown in Figure 2, most respondents measure innovation by its effect on either productivity or market success.

*Proposition 3: SI firms are more likely to measure innovation through changes in productivity or market growth rather than typical R&D investment.*

Insert Figure 2 about here

***Innovation engagement: innovation roles***

Because participants clearly had various perceptions of the concept of innovation, they were provided with the researchers' innovation definition[1], to ensure uniformity across interviewees regarding the same concept of innovation in the subsequent question. Our enquiry into the role that participants ascribed to innovation in their firms found that many firms identified significant changes and improvements regarding how the firm was now carrying out its business, compared to the recent past.

Out of the 17 participants who answered this question, only one firm said that innovation does not play a very great role in their company. Nine interviewees, however, stated that innovation is (very) important for their company (Figure 3).

[1] Innovation refers to a new idea or behaviour, including a product, service, system, program, device, process, or practice to an organization or an organizational sub unit. This may include an invention, an improvement, or diffusion of something pre-existing elsewhere.

> *It has been the absolute critical foundation of this company's success and continued success, has been and will be—innovation* (B12).

> *The main (important) thing is to improve your efficiency or your bottom line (*A4).

> *It (innovation) is a huge role* (B5).

Firms described the importance of innovation in their firms in multiple ways. Firstly, more than one company stated that innovation is crucial to their existence. The manager of a small Category B company, for instance, said that without their investments in innovations, they 'would not exist'. Secondly, innovation is described as a way to stay ahead of their competitors and growth. Examples are:

> *Being a service oriented company in a competitive environment, we need to continually look for innovation to improve the product and the service delivery. The clients won't stay with the same product, if someone else comes out and says oh you know, my widget has got a whistle for the same price, then they will go with that, even if they don't want a whistle, they will just say oh well, I'm getting more why wouldn't I want one with a whistle* (B5).

> *Our business is in a growing stage, so managing a growing business requires innovative ideas. Going by your definition we are introducing …. systems and processes, so that you are able to manage that growth and also compete. So it is not just about competing in the marketplace, but also about how you are growing the business* (C1).

*Proposition 4: SI firms that focus on business survival and competitive advantage are more likely to highly value innovation.*

Insert Figure 3 about here

***Innovation engagement: activities***

Subsequent to investigating respondents' views on innovation, we examined the innovations that had actually taken place in their firms during the past year. Many firms did not describe themselves as innovative. However, during the interviews, most firms described continuous improvements, and many interviewees reported one or more innovations in their firm during the past year. Out of the 20 interviewed companies, 14 mentioned one or more product or

service innovations during the last year. Six firms mentioned one or more marketing innovation, eight firms mentioned one or more process innovation and seven firms mentioned organisational innovations. Figure 4 provides an overview of the reported innovations.

Insert Figure 4 about here

The wide range of innovative activities, with product or service innovation being the most frequently mentioned are shown in Figure 4. Product innovations included, for example, a natural language search engine, the sales of new technology and the use of sophisticated graphs for image pattern recognition. Examples of marketing innovations included the use of social media and the introduction of several new marketing concepts. Process innovations included new manufacturing techniques and new processes to draw up plans, and organisational innovations included going public and the introduction of new management team work strategies.

Remarkably, relatively few of the interviewed Category A firms mentioned organisational or managerial innovations, while almost all Category B firms mentioned one or more product or service innovations. Firm size does not seem to have an effect on the type of reported innovations. Figure 5 provides an overview of the mentioned innovations per firm type.

Insert Figure 5 about here

As shown in Figure 5, Category A firms mentioned process innovation most frequently followed by product/service and marketing innovations. Almost all Category B firms mentioned marketing innovation with the other forms of innovation mentioned by fewer than half. All Category C firms mentioned both Process and Organisational/managerial innovation. Thus it seems that High Tech and Low Tech SI firms have different preferences for the types of innovation.

*Proposition 5: SI firms are more likely to engage in product and service innovations rather than other type of innovations*

***Innovation engagement: exploration or exploitation?***

Exploratory innovation offers new designs, creates new markets, and develops new channels of distribution. Conversely, exploitative innovation broadens existing knowledge and skills, improves established designs, and expands existing products and services, and increases the efficiency of production (Liao and Hu, 2007). Thus, the concept of exploratory innovation is akin to radicalness while exploitative innovation is relatively associated with incremental changes. We found that 13 firms reported that their innovations were new to the firm or industry, while 7 firms were reported as new to the world. Not surprisingly, most firms mentioned one or more innovations that were new to the firm. More surprising was the number of reported innovations that were new to the world. The new to the world innovations were all reported by the Category B firms, both small and medium/large firms. There was also a strong relationship between firm age and this type of innovation: all new to the world innovations were reported by firms founded after 1997, while firms in our sample that were founded before 1997 reported no new to the world innovations. Most innovations (18 firms) were incremental innovations.

*Proposition 6: Innovation activities in SI firms are more likely to be exploitation rather than exploration.*

***Innovation engagement: beneficial gains***

Apart from these innovation outcomes, most interviewees alluded to several other benefits their firm has gained from innovation. A large majority of interviewees referred to innovation as a key factor to increase their reputation, followed by sales or income, improved internal process and clientele, among other benefits. Examples are:

> *No doubt reputation improves; people like to see innovative companies. Customers don't always like to pay, but they like to think they are dealing with something new, sexy and good* (B17).
>
> *[Innovation] has built our reputation; it is wholly responsible for our reputation* (B12).

Another big Category B company claimed they have become market leader due to their innovation. An additional benefit from innovation reported by many firms is the improvement of the firm's internal processes, such as time efficiency. Many of the interviewees further reported that their innovations have helped them to attract new customers or to gain recurring customers. One large Category C firm reported that customers stay with the firm because of '*our innovative approach to doing it and our solutions are technically superior to the others*. The benefits of innovation included market expansion and eight of the 20 interviewees reported that their innovations contributed to their firm's internationalisation.

*Proposition 7: SI firms are more likely to associate innovation benefits with market expansion, including internationalization.*

***Facilitation and impediment of innovation engagement: Firm characteristics***

Time and monetary constraints proved to be the greatest barrier for the interviewed companies. The necessity to maintain their cash flow is especially important for small firms: eight out of nine small firms reported this as an innovation barrier, while only five out of 13 medium to large firms considered this as a concern. One of the interviewees described this as following:

> *Internally we might slow things down on the innovation if cash flow becomes an issue; then we concentrate more on client work* (B6).

Time and money constraints obstructed innovation equally in Category A and Category B firms: four out of six Category A firms, seven out of 12 Category B firms and both Category C firms described this as an innovation barrier.

***Facilitation and impediment of innovation engagement: internal factors***

While respondents mentioned their corporate culture as an important factor to enable innovation, a firm's corporate culture can also form a hindrance to innovate. Several firms mentioned opposition to the use of new technology or procedures in their firm as a barrier to innovate. A large Category A formulates the issue concisely as the old 'we've always done it that way' (A3). This resistance to change is reported as coming from staff, but also from a company's management, who were not easily persuaded to try innovative and new techniques.

Not only new technology, but also uncertain outcomes can cause resistance to innovation. Examples are:

> *Sometimes we get discouraged from pursuing the building of a completely different product because we're not sure how it is going to be received in the marketplace* (A3).
>
> *If you invest in something and it ends up being a waste of time you are shyer the next time around, even though it might better, you are shyer. So your corporate memory sometimes causes issues, and that is why we have probably had about a four year gap where we haven't been that innovative, and it is only now we are starting to get back into it* (B6).

**Facilitation and impediment of innovation engagement: external factors**

Seven respondents referred to government as a barrier to innovation: two Category A, one Category C and four Category B firms,. Three were small firms, while four were medium to large. One of their concerns regarded government 'attitude' in general, such as government's focus on mining and little investment in the commercialisation of innovation. A large Category B company (B1), for instance, calls the government 'conservative and tardy', which is an important barrier to innovation, because he feels that for the government, 'process becomes more important than the result'(B7).

Perceptions of excessive paperwork or procedures are also reported; a small Category A firm for instance refers to the 'requirements for tendering as a massive process that discourages small operators' (A4). In some cases, government regulations could be perceived as a barrier. A small Category A firm (A2) referred to the Surveyor's Act, which prescribes the presence of a second person while using GPS instruments for safety regulations. He

judged this to be sensible in cities with much traffic, but not in a paddock. Also reported was a local council initially opposing a small Category A's innovative approach (A1). One large Category C firm stated that government internal processes and procurement were a barrier to competition.

### Other Internal and External Factors

In addition, other issues were mentioned by firms. Three firms reported having had various technical issues when developing or introducing their innovation. One large and two small companies refer to the company's size as a barrier; in the case of the small firm, the interviewees referred to a lack of internal skills. Other examples include outsiders not believing in the innovation or cooperating with a big foreign company with their own procedures. Further, a respondent mentioned tight customer requirements:

> *I notice people are getting quite prescriptive now about how they want things done and sometimes you don't get much leeway to improve the process. You need to follow what they prescribe* (B8).

Despite being the greatest enhancer for innovation, some customers can also hamper innovation, which makes them an influential factor for innovation within this industry.

*Proposition 8: Firms size, organizational culture and government regulations are important factors to influencing innovation among SI firms.*

## DISCUSSION AND CONCLUSIONS

Our examination of innovation activities in the SI firms revealed how firms perceive and engage in innovation as a part of their business operation. While innovation is understood as both a process and an outcome (Crossan and Apaydin, 2010), nonetheless, the distinction between process and outcome of innovation are not clear cut, according to the authors. These authors synthesized past studies of innovation mostly based on large organisations and described that organisations viewed innovation as to "how to" innovate and "what to" innovate. SI firms compete in a fast changing market where increasingly sophisticated technology, thus creating new ways of working, new ways of solving problems and faster,

more accurate and more efficient solutions driving innovation activities within this sector.

Our qualitative findings suggest that SI firms typically define innovation more broadly and toward product/service as a process innovation in terms of something new to increase efficiency or solve a problem. This finding perhaps could impact how SI firms, especially small firms, report a number of innovation activities. For example, we conducted a follow-up survey with additional 64 SI firms, asking number of innovation activities (based on the UK innovation survey). The innovation activities which are most mentioned product and/or service innovations. Some mentioned marketing innovations, such as the use of social media. Process innovations mentioned included new manufacturing techniques and organisational innovations included going public and new teamwork strategies. As can be expected, smaller SI firms had the lowest innovation activities, comparing to larger SI firms.

We found that most of our case firms tended to view innovation as a process, that is how to innovate in order to improve internal processes and clientele, among other benefits. This is akin to Crossan and Apaydin's (2010) study where innovation is also viewed not only as an outcome but also as a process. Recent research on the approach of small and medium sized firms to their environment and situation suggest that "*fostering an innovation orientation has more positive effects on firm performance than creating innovation process outcomes such as patents or innovative products or services*" (Rosenbusch et al., 2011).

Our findings also confirm Choi & Shepherd's (2004) findings that small firms are more likely to exploit opportunities when they perceive more knowledge of customer demand for the product and more fully developed technologies. The firms in this study ascribed much of their success as being related to their closeness to customers and knowledge of customer's concerns and demands. Our study provides some indication that firm level entrepreneurial attitudes and behaviours are strongly linked to the innovative activities initiated by firms to maintain or improve their business performance.

Our study needs to be interpreted with consideration given to the limitations of the research. Our samples were drawn from a specific industry, and thus generalizability cannot be claimed. Nonetheless, our study contributes to our knowledge of innovation by highlighting the differences size makes in approaches to innovation and the importance of treating SMEs different than large corporations. We also highlight the potential differences between High and Low Tech firms in their approaches to innovation. This study used an inductive qualitative approach to generate ideas for future studies. All of our findings provide opportunities for further research into innovation in High and Low Tech SMEs, in other industries and in other countries.

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**Table 1. Key informants for our interview study**

| Firm code | Interviewee's function | Firm category | Firm size | Firm location |
|---|---|---|---|---|
| A1 | Director | Category A | Small | NSW |
| A2 | Managing Director | Category A | Small | NSW |
| A3 | Director | Category A | Medium | NSW |
| A4 | Registered cadastral Surveyor, Owner | Category A | Small | QLD |
| A5 | Office Manager | Category A | Medium | QLD |
| A6 | General Manager; Operational Manager | Category A | Small | WA |
| B1 | Chief Executive Officer | Category B | Medium | ACT |
| B2 | Managing Director, Owner | Category B | Small | NSW |
| B3 | Survey Manager | Category B | Large | QLD |
| B4 | Managing Director | Category B | Small | QLD |
| B5 | Manager | Category B | Small | VIC |
| B6 | Managing Director, Geo spatial systems developer | Category B | Small | VIC |
| B7 | Client executive | Category B | Large | VIC |
| B8 | Managing Director | Category B | Medium | VIC |
| B9 | Managing Director, Chief Executive Officer | Category B | Medium | VIC |
| B10 | R&D Manager | Category B | Medium | WA |
| B11 | Managing Director | Category B | Medium | WA |
| B12 | Chief Executive Officer | Category B | Medium | WA |
| C1 | GIS Coordinator | Category C | Small | VIC |
| C2 | Business Development Manager | Category C | Medium | WA |

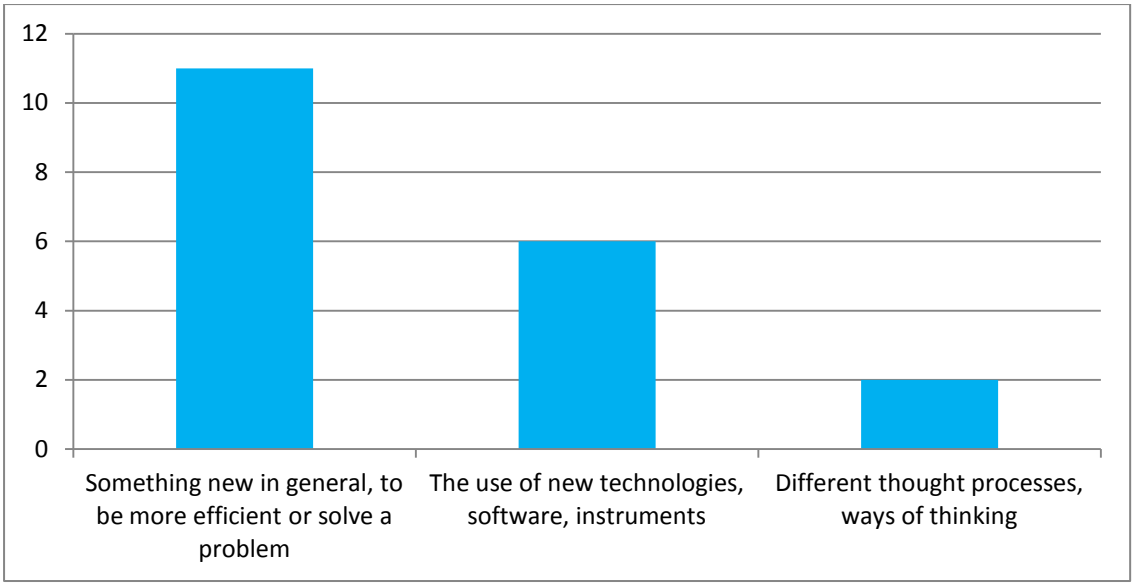


Figure 1: Interviewee's definitions of innovation

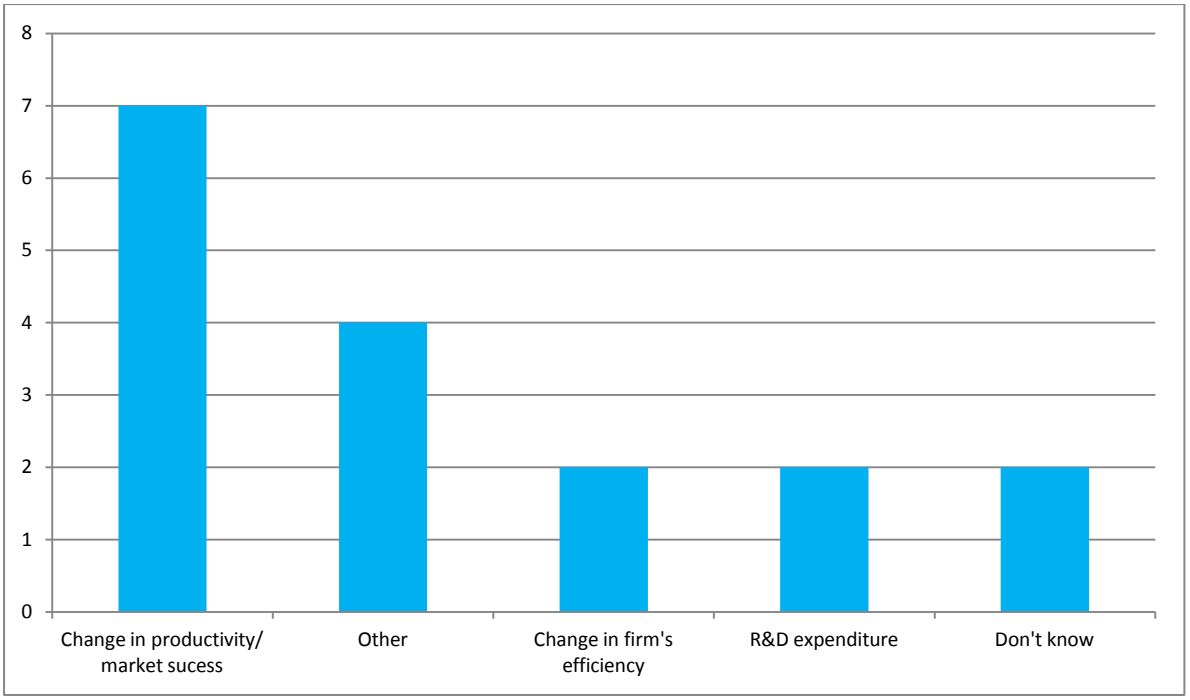


Figure 2: Interviewees' Views on Measuring Innovation

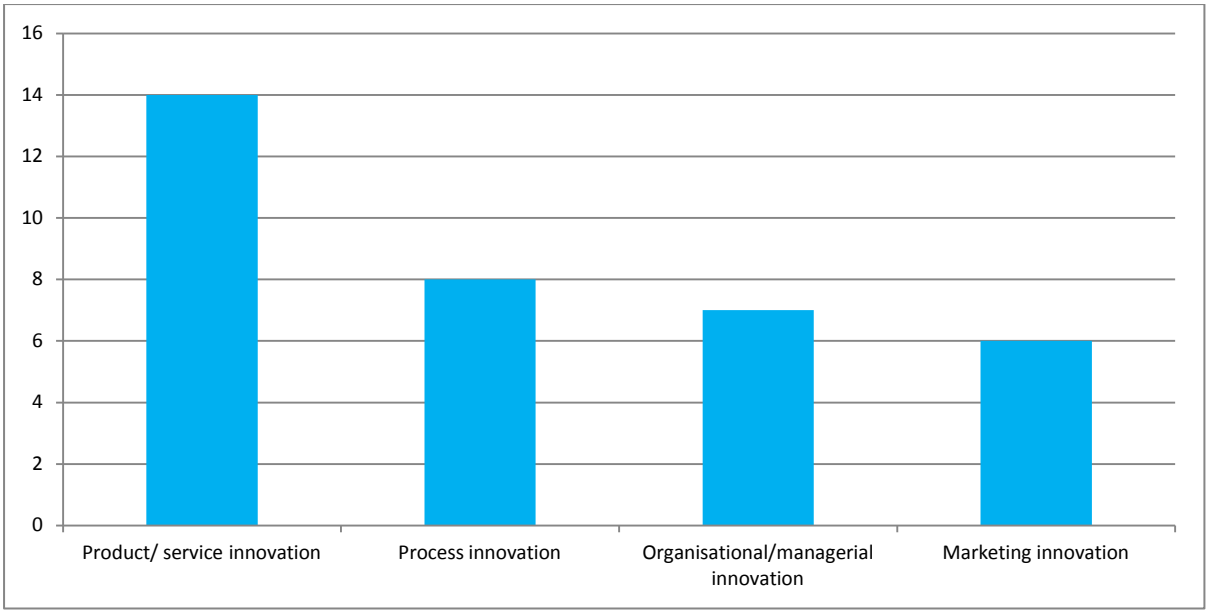


Figure 3: Reported innovations by interviewees

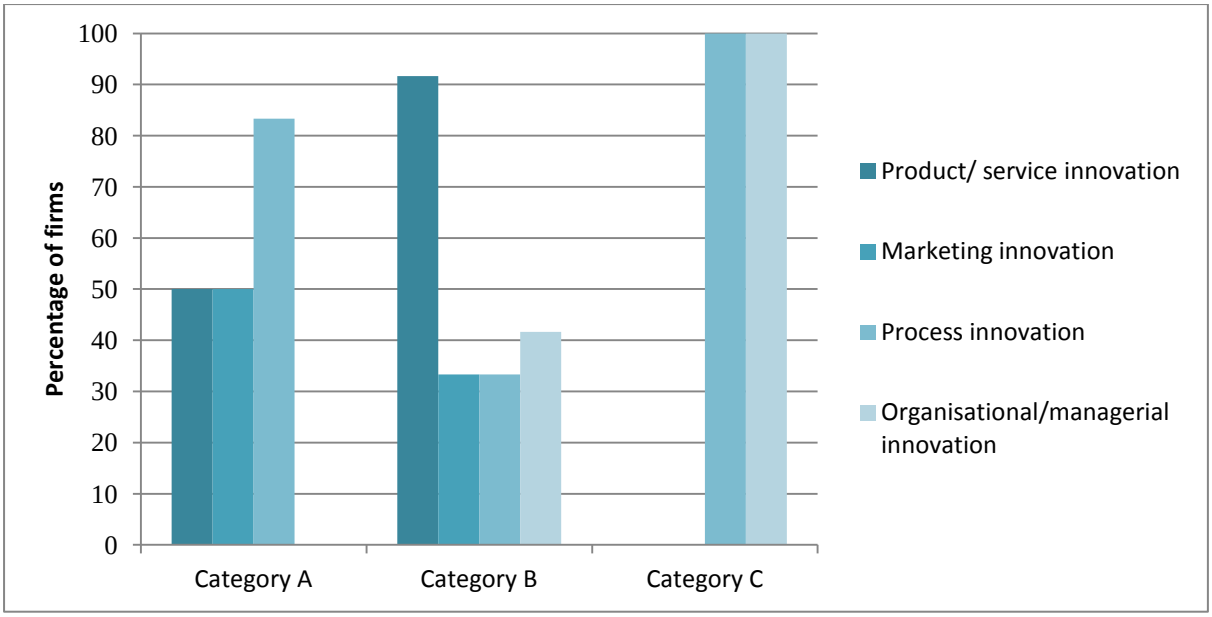


Figure 4: Innovation types by firm type

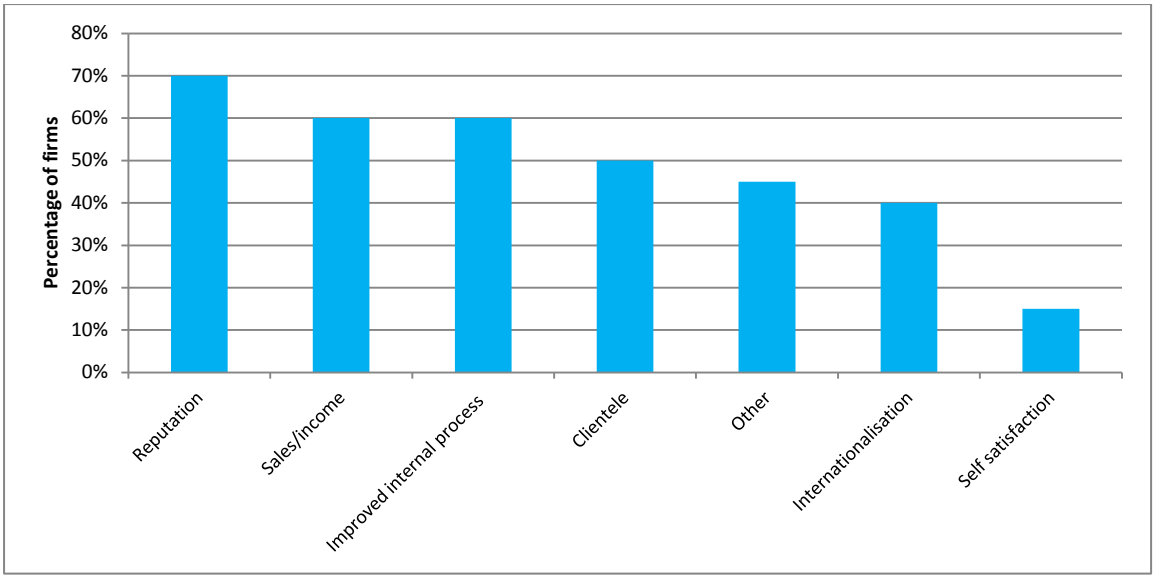


Figure 5: Reported benefits of innovation